DETERMINATION OF RELATIONSHIPS BETWEEN DISTRIBUTIONS OF STIMULI AND DISTRIBUTIONS OF JUDGMENTS UNDER INSTRUCTIONS OF DIFFERING SPECIFICITY

BY

PRISCILLA DATTMAN BLEKE

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by

Priscilla Dattman Bleke

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P. D. B.

CONTENTS

DETERMINATION OF RELATIONSHIPS BETWEEN DISTRIBUTIONS OF STIMULI AND DISTRIBUTIONS OF JUDGMENTS UNDER INSTRUCTIONS OF DIFFERING SPECIFICITY

INTRODUCTION

Basic to the judging process is the relating of a given item to a group of items. The simpler case of judging is one in which an item is compared with another which is simultaneously present while the more complex case consists in comparing an item with previously experienced items. Analysis of the latter process was given impetus by Wever and Zener (8) who introduced a method of investigation applicable to this problem of judgment in time. Positing that even simple comparisons draw heavily upon an extended context of experiences, these investigators demonstrated that their method of presenting for judgment single members of a stimulus series gives data comparable to that obtained with the traditional method of constant stimuli.

Wever and Zener and investigators who subsequently utilized the method of single stimuli have demonstrated that subjects are able to make consistent judgments which are sensitive to small increments of change in the stimulus series. Additional studies

have investigated some of the influences that modify judgments such as changes in end stimuli or stimulus density, and aspects of the stimulus distribution to which judgments are anchored. Several reviews of the research in this area are available (5, 6, 7).

In addition to laboratory findings everyday life offers many examples of the utilization of judgments which reflect previous experiences with the stimulus dimension involved. The basis for such characterizations as "a tall man", "a fascinating lecture", "a good meal" is admittedly more involved than the basis for usual laboratory judgments but the same general principles may be assumed to underlie both.

In both the laboratory and the social situation the process of relating one item to a non-present set of items is dependent upon a temporal integration of the effects of previous contacts with items of that set. It is meaningful, therefore, to examine the functional dependence of distributions of judgments upon previous experience with items of the same set as the ones being judged. This problem is implicit in several different lines of research such as investigations of shifts in judgments, where the underlying assumption is that changes in judgment reflect changes in the fundamental character of the stimulus distributions, and empirical studies of anchoring, which in general follow the pattern of modifying essentially rectangular stimulus distributions. Both types of investigation represent efforts to discover the aspects of a stimulus distribution to which judgments are related.

The present study is composed of several experiments which

were designed to investigate systematically general relationships obtaining between different distributions of stimulus items and distributions of judgments elicited by these items with attention to such factors as differences in the instructions, the number of judgment categories and the step-interval between items. In all experiments the subjects were required to judge the length of singly presented horizontal lines.

The first group of four experiments represents an effort to discover the form of the basic functional relationship in relatively unstructured situations which are representative of most judging tasks. The initial experiment consisted of separate groups of subjects judging one of five different distributions of stimulus items. All the distributions (rectangular, symmetrical unimodal, bimodal, positively skewed, negatively skewed) had the same range and density of items and two categories of judgment (longer or shorter) were available to the subjects.

The second experiment was designed to investigate the influence of the factor of stimulus distribution on judgments rendered by subjects who experience successively more than a single stimulus distribution, since in life situations individuals do not typically experience one clearly defined distribution of similar stimulus items. Rather they have a variety of contacts with items whose distribution may vary over a period of time.

The aspect of the judging situation which was altered in the third experiment was the number of judgment categories. In order to determine the effect of the distributional properties of the stimulus items on judgments in multiple category situations the

number of categories available to the subjects was increased from two to three (longer, medium, shorter).

In the fourth experiment the step interval between stimulus items was increased from a barely supraliminal to a clearly discriminable one. This was done in order not to restrict the findings of the study to situations such as those of the traditional psychophysical experiments where the step-interval is in the region of the limen.

In the first four experiments the instructions to the subjects were very general, and thus the question is raised whether the relationships obtained under these conditions depend upon varying individual interpretations of the task. The last two experiments in this study were designed to investigate the effect of more explicit instructions with the aim of obtaining results which could be compared with the relationships found between distributions of stimuli and distributions of judgments in the more representative unstructured situations.

THE EXPERIMENTS

The Experimental Situation

Several considerations governed the specification of the exact experimental situation. First, it was essential that the task be a simple, clean-cut one for the subjects. Secondly, the stimulus items should vary along only one dimension to which judgments could be related. Thirdly, the stimulus items should be of a sort facilitating rapid presentation so that subjects could render a large number of judgments in an experimental hour. The stimulus items chosen as satisfying these requirements consisted of bright horizontal lines projected onto a screen placed eleven feet in front of the subjects seated in a dark experimental room. The lengths of the projected lines measured 11.7", 12.4", 13.0", 13.7" and 14.3" for Experiments I, II, III, V, VI[1] and 11.7", 13.0", 14.3", 15.7" and 17.3" for Experiment IV.[2]

---

1. This 5% difference in length was determined empirically to be just above the limen.

2. The lines will be indicated hereafter by numbers with 1 being the shortest and 9 the longest.

These lines were projected for a duration of one second so that the midpoints of all lines fell at the same position in the middle of the screen. The lines were identical in width and were not identifiable except by length which was the dimension on which the subjects judged each item.[3]

The subjects sat in a row of five closely placed chairs. They communicated their judgments to the experimenter by pressing one of several keys mounted on the arm of each desk-chair. The keys, which were covered by a metal dome to prevent mutual knowledge of judgments among the subjects, operated a panel of lights in the experimenter's projection cage in an arrangement which facilitated rapid recording of the subjects' responses.

The Stimulus Distributions

In any particular experimental session the number of times a given line was presented differed according to the stimulus distribution scheduled for that session. Each distribution consisted of a total of 150 presentations of the five different lines as indicated in Table I. The order of presentation of items in all of the different distributions was such as to maximize contact with the entire range of items as frequently as possible. If, for example, a certain line was represented fifteen times in the total 150 presentations it appeared once in every ten lines; a line represented thirty times appeared approximately once in every five lines.

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3. The slides were made of metal strips with cleanly beveled edges separated by a gap of .003 inch.

TABLE I

FREQUENCIES OF LINE IN VARIOUS STIMULUS DISTRIBUTIONS

DISTRIBUTION	LINES 1	2	3	4	5
RECTANGULAR	30	30	30	30	30
SYMMETRICAL UNIMODAL	15	30	60	30	15
BIMODAL	40	30	10	30	40
SKEWED -.32[a]	20	25	30	35	40
SKEWED +.32	40	35	30	25	20
SKEWED -.92	10	20	30	40	50
SKEWED +.92	50	40	30	20	10
SKEWED -1.22	5	10	20	40	75
SKEWED +1.22	75	40	20	10	5

a. The amount of skew is expressed in terms of alpha three.

$$\alpha_3 = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^3}{S^3} \qquad (3)$$

Table II contains the information as to which stimulus distributions were used in the six different experiments.

The Procedure

The following procedure was maintained throughout the study except where the variations among the experiments are specifically noted. At the beginning of each experimental session the

TABLE II

STIMULUS DISTRIBUTIONS USED IN EACH EXPERIMENT

				STIMULUS DISTRIBUTIONS[a]					
EXPERIMENT	R	U	B	-.32	+.32	-.92	+.92	-1.22	+1.22
I	X	X	X			X	X		
II	X	X	X			X			
III	X	X	X			X	X		
IV	X	X	X			X	X		
V	X	X	X			X	X		
VI	X			X	X	X	X	X	X

a. The letters R, U and B refer to rectangular, unimodal, and bimodal distributions: the numbers refer to the variously skewed distributions.

subjects were read the following instructions:

> You are going to see lines of different lengths flashed on the screen one at a time. You will indicate whether a line is among the longer or shorter of the lines presented.
>
> To indicate your judgments you will use the keys resting on the arm of your chair. Press the extreme left one to signify a judgment of "shorter", the extreme right one to signify a judgment of "longer." Continue to press either key after making a judgment until told to release it.
>
> Before each line is flashed on the screen the signal "ready" will be given.
>
> Please do not talk or give any indication of your judgments to the other subjects. Any questions?

At the conclusion of the instructions the lights were turned off and the slides were projected at the rate of approximately one slide every fifteen seconds. Two short rest pauses were intro-

duced after the fiftieth and hundredth judgments. The subjects were not informed as to the purpose of the experiment.

The Subjects

The subjects were 197 men and women college students at Duke University. Except for one group of ten graduate students all the subjects were undergraduates who were naive as to the purpose of the experiments.

The Individual Experiments

The conditions of the six experiments are specified in Table III under the headings: instructions, difference in magnitude between stimulus items, stimulus distributions, categories of judgment and number of subjects. Detailed aspects of the differences among the experiments will be discussed in relation to the results of these experiments but, in brief, the differences are as follows. Experiment I consisted in presenting five different stimulus distributions to separate subject groups who judged each singly presented item on a two category basis. Experiment II differed from Experiment I in that it employed one group of subjects who served as their own controls in all the experimental sessions. Experiment III was identical to I except that the subjects used three rather than two categories of judgment. In Experiment IV the step-interval between stimulus items was doubled but in every other respect the design was comparable to

that of Experiment I. The instructions were modified in the last two experiments. In Experiment I the subjects were instructed not to assume that there were necessarily equal numbers of shorter and longer lines. In Experiment VI the instructions were still more detailed. One group of subjects was instructed to use the median of each stimulus distribution as the basis of judgment and a second group was instructed to use the midpoint of the range of stimulus items as the basis. In contrast, the control group in this experiment was given the more general set of instructions.

TABLE III

THE INDIVIDUAL EXPERIMENTS

EXPT.	INSTRUCTIONS	ITEM DIFFERENCE	STIMULUS[a] DISTRIBUTIONS	JUDGMENT CATEGORIES	NUMBER OF SUBJECTS
I	GENERAL	5%	R, U, B, -.92,+.92	TWO	50[b]
II	GENERAL	5%	DAY 1 R DAY 2-.92 DAY 3 U DAY 4 B	TWO	7[c]
III	GENERAL	5%	R, U, B, -.92,+.92	THREE	50[b]
IV	GENERAL	10%	R, U, B, -.92,+.92	TWO	50[b]
V	FOREKNOWLEDGE OF POSSIBLE INBALANCE IN DISTRIBUTION	5%	DAY 1 R DAY 2-.92 DAY 3 U DAY 4 B DAY 5+.92	TWO	10[c]
VI	A GENERAL	5%	DAY 1 R DAY 2-.92 DAY 3+1.22 DAY 4-.32 DAY 5+.92 DAY 6-1.22 DAY 7+.32	TWO	10[c]
	B DETAILED: JUDGMENTS BASED ON MEDIAN	5%	SAME AS A	TWO	10[c]
	C DETAILED: JUDGMENTS BASED ON MIDPOINT	5%	SAME AS A	TWO	10[c]

a. R, U, and B refer to rectangular, symmetrical unimodal and bimodal distributions respectively. The skewed distributions are designated by alpha three.

b. Groups of 10 subjects each were used for each stimulus distributions.

c. Each subject was used for all stimulus distributions.

RESULTS AND DISCUSSION

The results of the six experiments will be discussed in two main sections. The first section consists of Experiments I, II, III and IV which differed among themselves as previously specified but which were identical with respect to the very general instructions given to the subjects. The second section consists of Experiments V and VI in which more specified instructions were given to the subjects.

Experiments I, II, III and IV

In Experiment I the subjects judged the different lengths of line in terms of two categories, shorter and longer. The judgments of the five groups of subjects who were given the different distributions of stimulus items are treated in terms of percentages of longer judgments for each line. The means (in percentages) for each group of ten subjects are plotted for each line

in Figures 1 and 2. Figure 1 contains the curves for the three symmetrical stimulus distributions- rectangular, symmetrical unimodal, and bimodal; Figure 2 contains the curves for the skewed distributions. In the former the curves are typical psychophysical ones, i.e., they describe a normal ogive. For all three the extreme stimuli were judged correctly about 90% of the time and the middle line was not consistently designated as either shorter or longer. The slight differences among the three curves may well be due to individual differences among the subject groups ascribable to errors of random sampling. In Figure 2 the curves for the skewed distributions differ from both the Figure 1 curves and from each other. In the case of the negatively skewed distribution the subjects distributed their judgments so that, not only was line one designated 100% of the time as shorter, but also lines two and three received proportionately more shorter responses than they had in the symmetrical distributions. As a result, for this group line four rather than line three represented the subjective median of the distribution in the sense that line four had equal probability of being judged shorter or longer.

On the other hand, subjects experiencing the positively skewed distribution of items judged line five correctly 100% of the time and the subjective median of the distribution was between lines two and three. This consistent difference between judgments rendered in the context of skewed stimulus distributions is obvious in the plot of the individual subject values in Figure 3. Only in the case of three data points for lines one and two do the

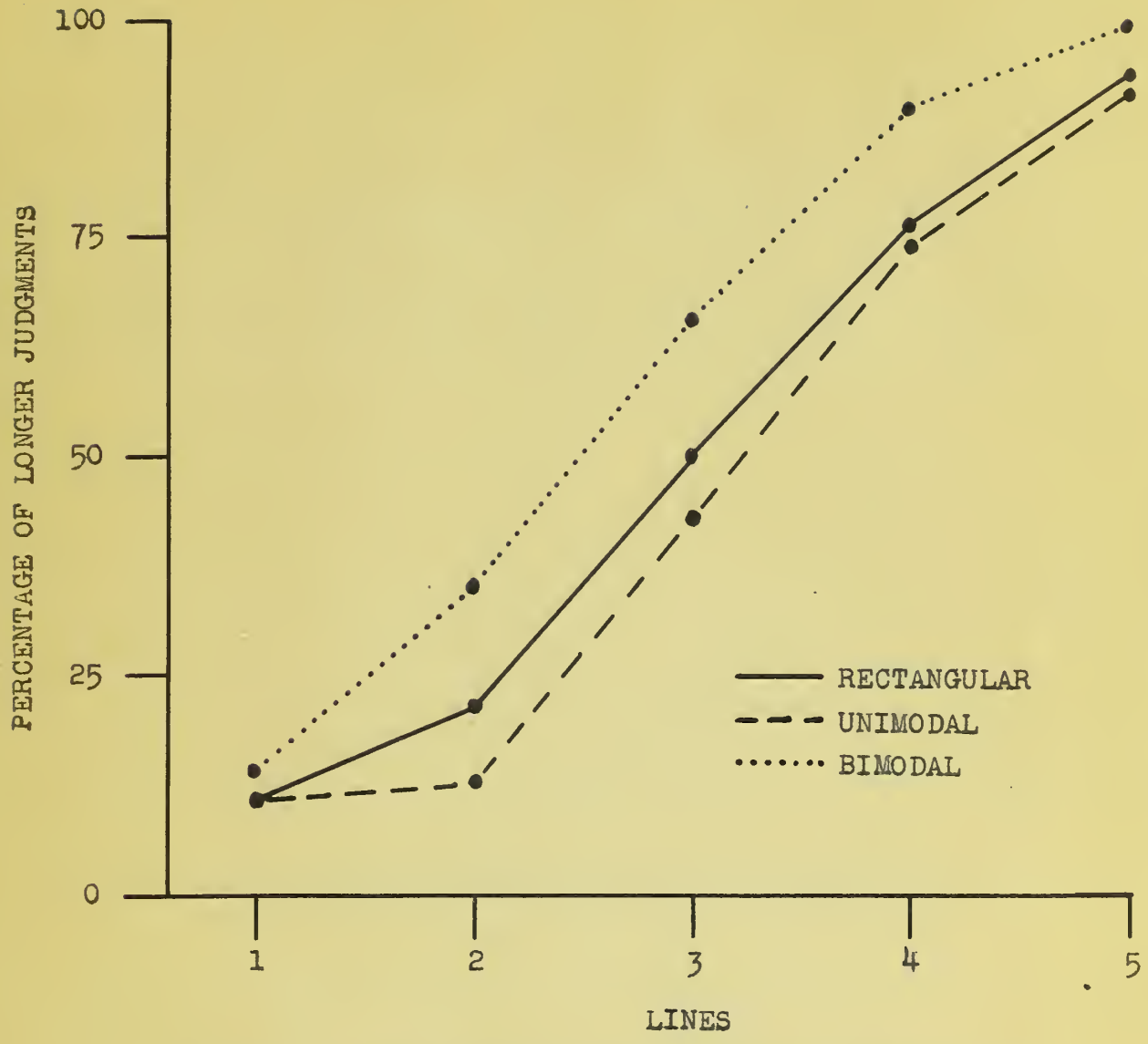

FIGURE 1 - MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN THE SYMMETRICAL STIMULUS DISTRIBUTIONS (EXPERIMENT I)

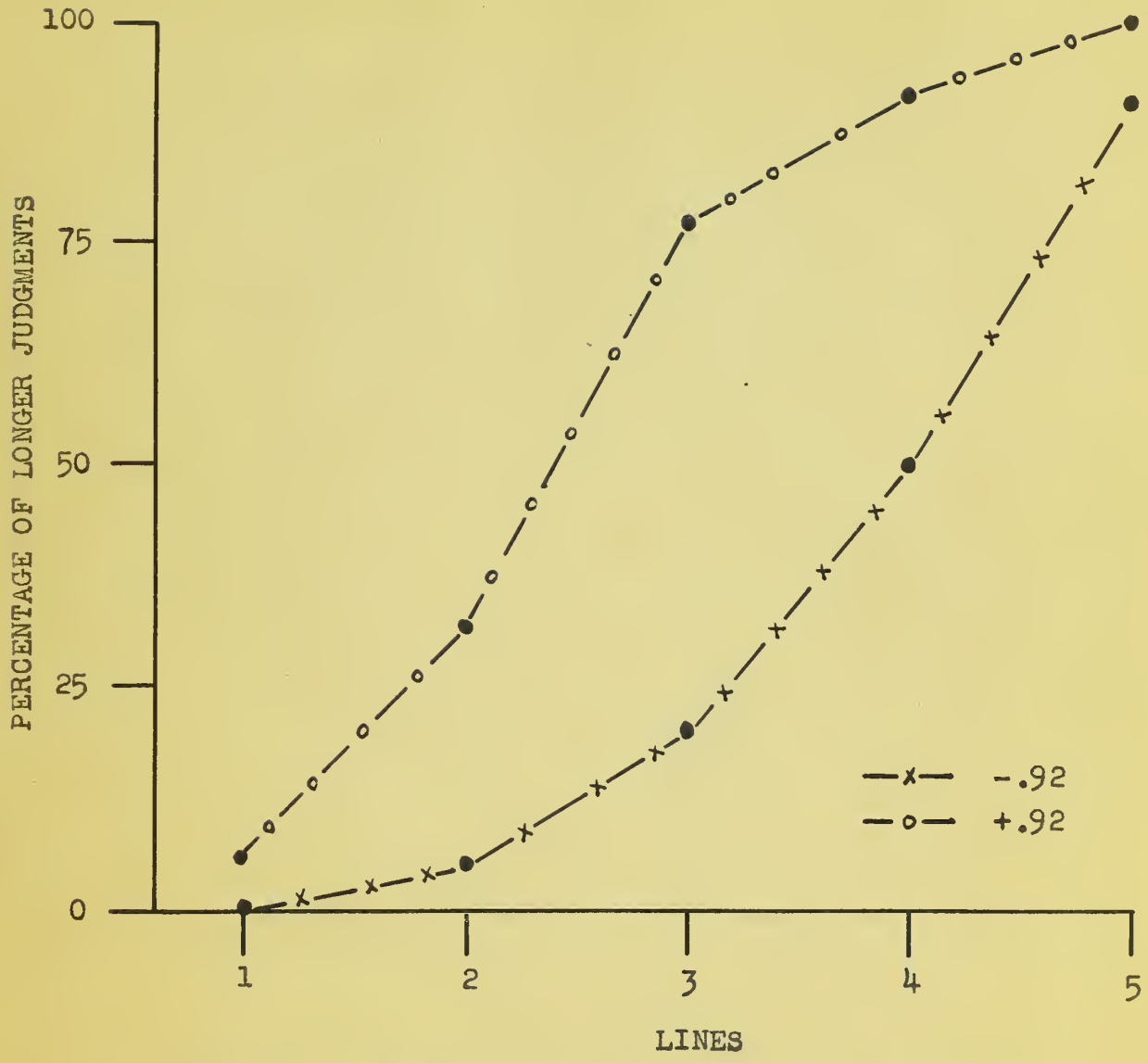

FIGURE 2 - MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN THE ASYMMETRICAL STIMULUS DISTRIBUTIONS (EXPERIMENT I)

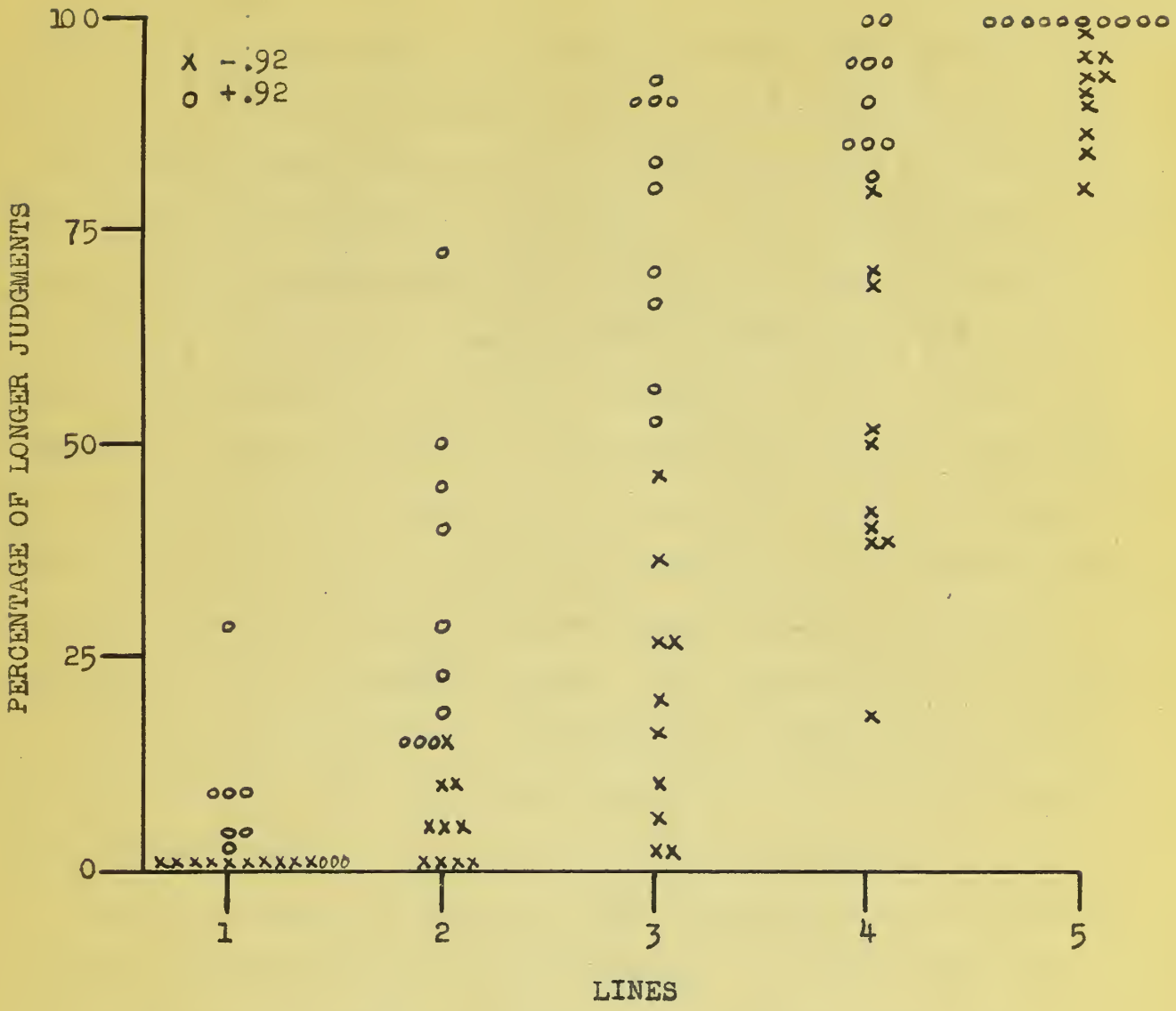

FIGURE 3 - INDIVIDUAL SUBJECT VALUES IN PERCENTAGES OF LONGER JUDGMENTS FOR EACH LINE IN TWO SKEWED STIMULUS DISTRIBUTIONS (EXPERIMENT I)

two populations meet.

In Experiment II the data for the one group of subjects who participated in all four[1] experimental sessions are plotted in Figure 4. The means in percentages of longer judgments for each line show the same trends as do the judgments given by the separate groups of subjects in Experiment I. The distributions of judgments of items in symmetrical stimulus distributions differ from the distribution of judgments in the remaining negatively skewed distribution as was noted in the data of the previous experiment. There is, however, greater similarity among the curves for the symmetrical distribution than was evident in Experiment I which may result from the fact that the curves are obtained from a single group of subjects thereby reducing the possibility of differences due to sampling errors. The important thing to note is that the distribution of judgments may be manipulated within an experimental series by changing only the distribution form of the stimulus items.

Three categories of judgments were available to the groups of subjects participating in Experiment III[2]. To facilitate comparison with the results of Experiments I and II the subjects' judgments are treated here in terms of mean category values.[3]

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1. The only skewed distribution used in Experiment II was the negatively skewed one because the total group of subjects was not available for more than four experimental sessions.

2. The general instructions were augmented to include ..."You will indicate whether a line is among the longer or medium or shorter of the lines presented" and a reference to the key to press to indicate a judgment of medium.

3. The judgments of shorter, medium and longer were assigned values 1, 2 and 3 respectively, and these values were averaged for each stimulus item (1).

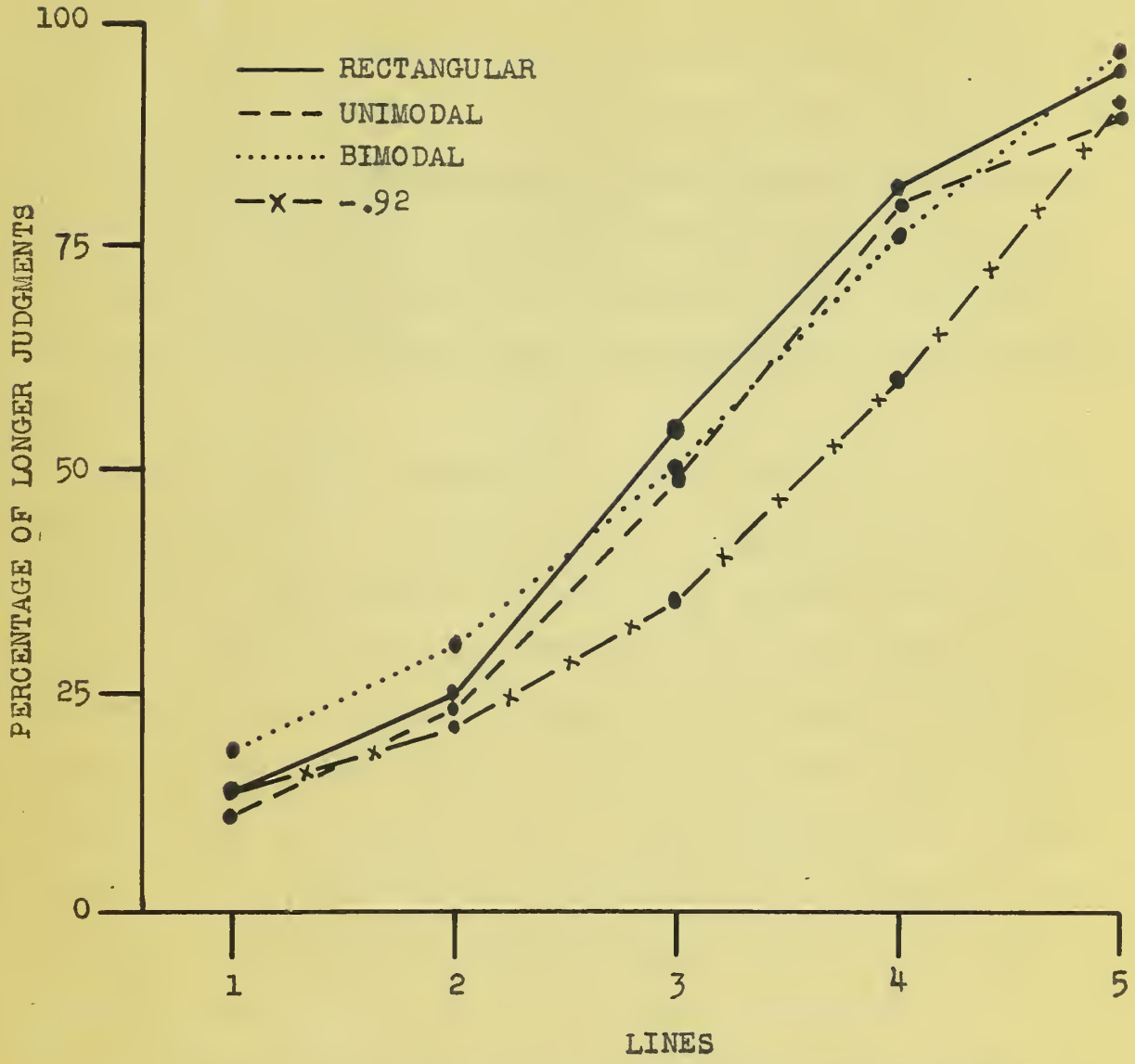


FIGURE 4 - MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT II)

In Figure 5 the curves for the different stimulus distributions are consistent with the results of the previous experiments utilizing the simpler case of dichotomous categories of judgment. Those for the rectangular, symmetrical unimodal and bimodal distributions are again essentially equivelent while those for the skewed are considerably separated from the symmetrical ones throughout the entire range of stimulus items. At no point do the curves for the asymmetrical distributions touch the symmetrical ones.

The step-interval between stimulus items was increased in Experiment IV from the 5% difference in the previous experiments to 10%. The judgments of the groups of subjects who dichotomized the more grossly separated five lines into categories of shorter and longer are presented in Figure 6. The general shape of the curves is that which has been noted in the first three experiments. There is, however, less obvious dissimilarity between the slopes of the curves for the symmetrical and asymmetrical distributions. The difference appears largely in connection with the judgments accorded to line three which is consistently labeled shorter in the negatively skewed distribution and longer in the positively skewed one.

The results of Experiment I, II, III and IV are strikingly similar. In every comparison of the curves of the symmetrical and asymmetrical stimulus distributions there is the suggestion that the judgments rendered in connection with a given line are influenced by the relative frequency of occurrence of that line. This factor of frequency of occurrence appears basic to the

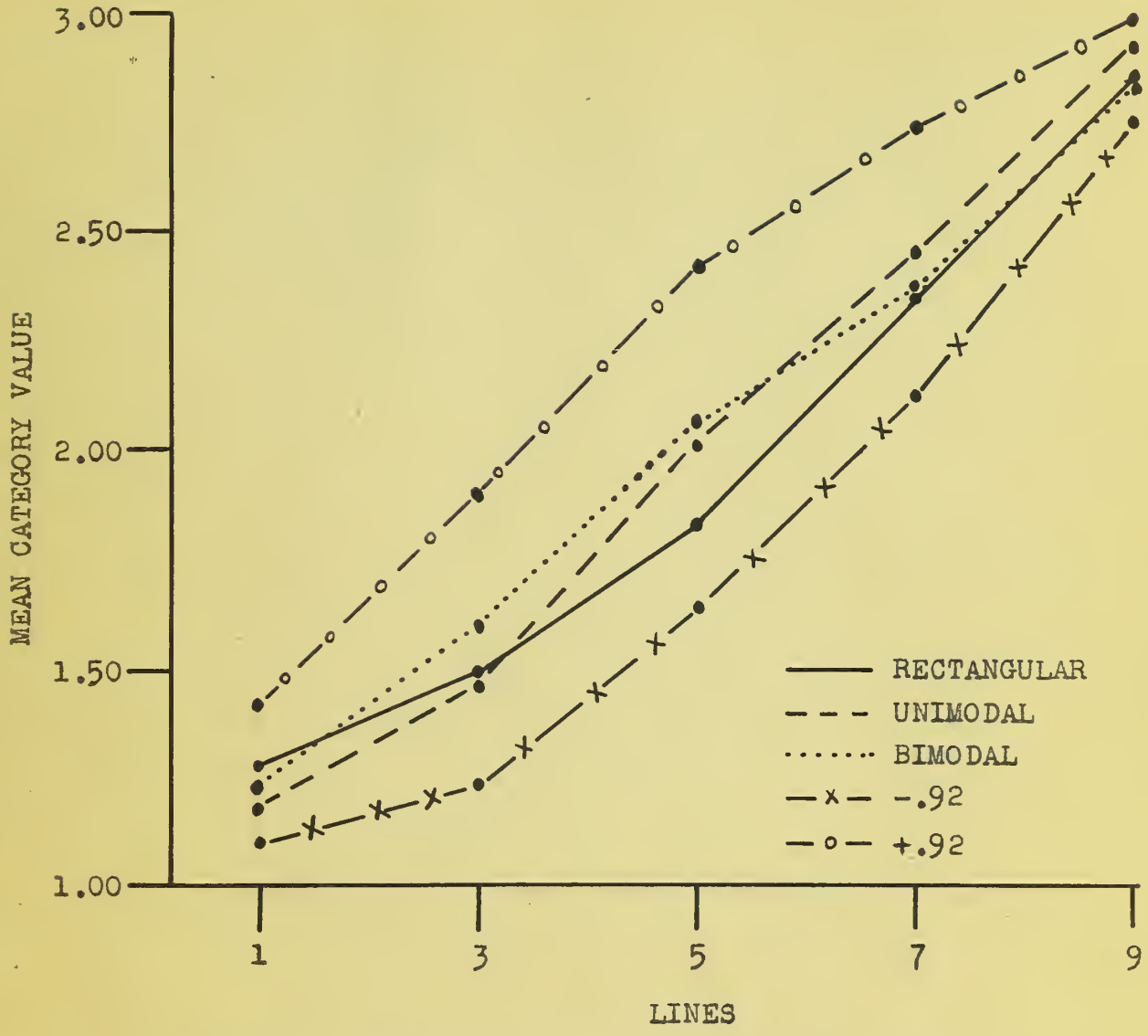


FIGURE 5 - MEAN CATEGORY VALUE FOR EACH LINE IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT III)

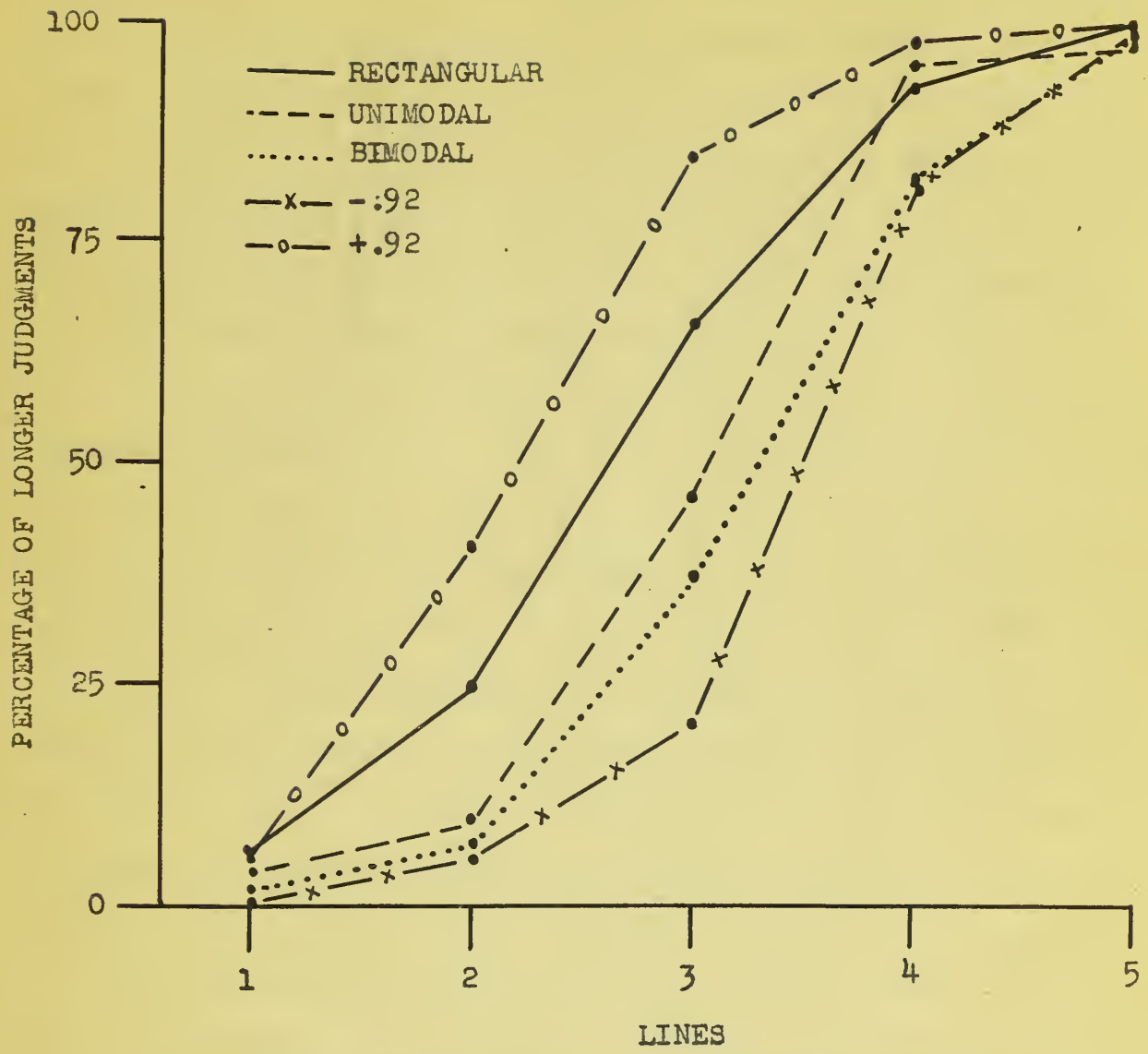


FIGURE 6 - MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT IV)

differences in judgments of items which are objectively identical in the various stimulus distributions. These general findings are in conformity with the "central tendency" explanation of judgment suggested by Hollingworth (4) who found that the judgment of an item of a series is not influenced so much by "...its general relation to other members of the series or by the effect of an immediately preceding member as by its specific relation to the central tendency or mean or average of the series."[4]

As a step toward a more precise understanding of the central tendency principle we may examine a further breakdown of the data in Figure 7 where the subjective median of each judgment distribution is plotted against the median of its stimulus distribution. In all four experiments the consistency of the relationship among the several stimulus distributions reveals the influence of the median of the frequency distribution rather than the midpoint of the range of line lengths as an important factor in the judgment distribution. The group data in Table IV show that this is definitely the case for the two category situations in Experiments I, II and IV where longer judgments are rendered very close to 50% of the time. This generalization holds even for the skewed distribution where on the basis of object differences of line representation, percentages of longer judgments might be expected to occur as high as 70% for the negatively skewed distribution and as low as 30% for the positively skewed one. In Experiment III the use of the available three categories of judgment is again uniform for the various stimulus distributions. As is evident in Table V shorter and longer were each used consistently

4. H. L. Hollingworth, "The inaccuracy of movement", Archives of Psychology, 1909, No. 13, p. 37.

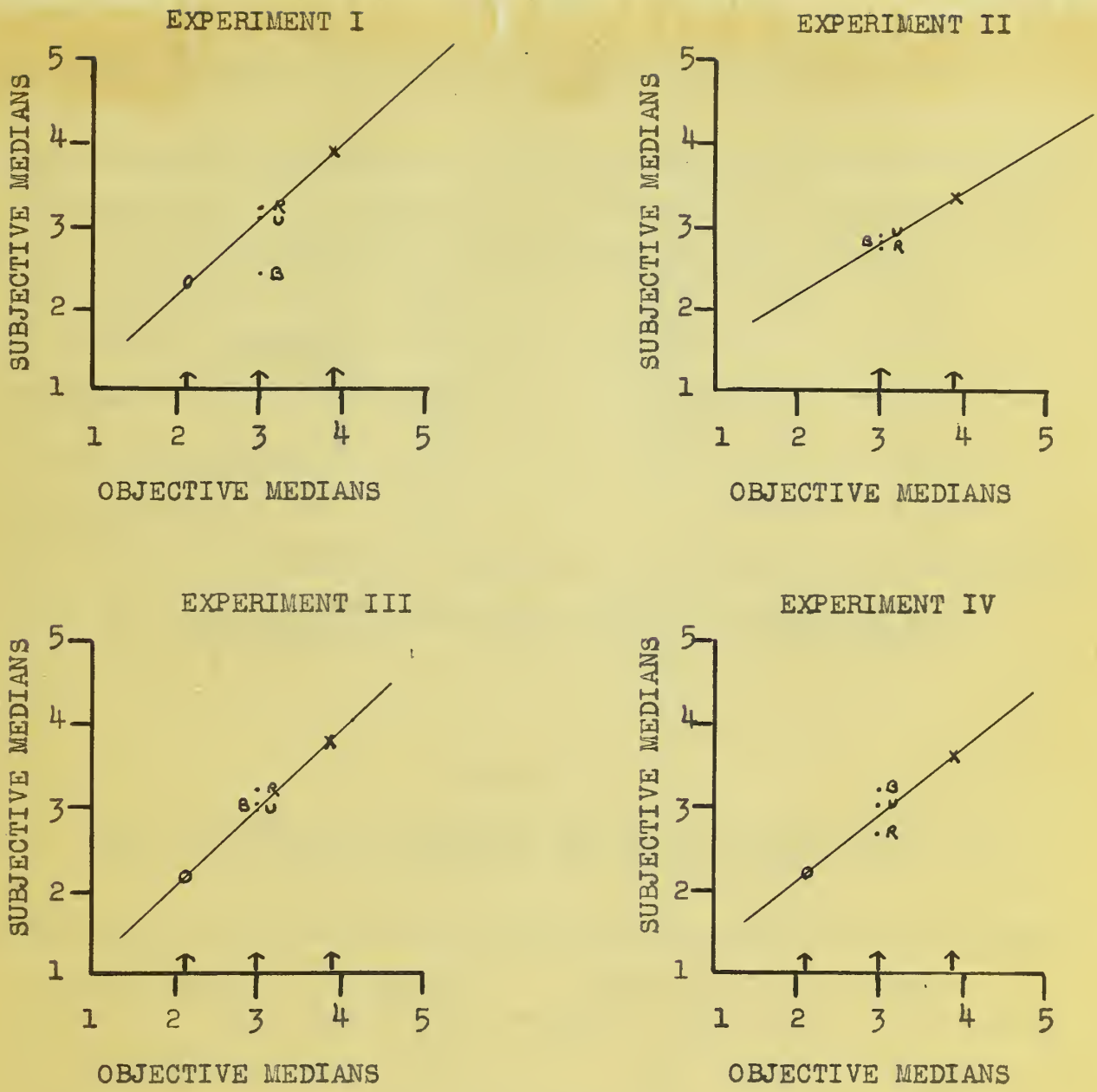


FIGURE 7 - SUBJECTIVE MEDIANS OF JUDGMENT DISTRIBUTIONS PLOTTED AGAINST OBJECTIVE MEDIANS OF STIMULUS DISTRIBUTIONS (SHOWN BY ARROWS) IN EXPERIMENTS I, II, III AND IV

TABLE IV

MEAN PERCENTAGE OF LONGER JUDGMENTS FOR ALL STIMULUS DISTRIBUTIONS IN EXPERIMENTS I, II, AND IV

DISTRIBUTION	EXPERIMENT I[a]	EXPERIMENT II[b]	EXPERIMENT IV[a]
RECTANGULAR	51	54	58
SYMMETRICAL UNIMODAL	45	50	49
BIMODAL	50	55	49
SKEWED (-.92)	48	57	60
SKEWED (+.92)	45		49

a. N = 1500 judgments for each stimulus distribution.
b. N = 1050 judgments for each stimulus distribution.

TABLE V

MEAN PERCENTAGE OF SHORTER, MEDIUM AND LONGER JUDGMENTS FOR ALL STIMULUS DISTRIBUTIONS IN EXPERIMENT III

DISTRIBUTION[a]	SHORTER	MEDIUM	LONGER
RECTANGULAR	30	43	27
SYMMETRICAL UNIMODAL	24	47	29
BIMODAL	30	40	30
SKEWED (-.92)	27	41	32
SKEWED (+.92)	26	46	28

a. N = 1500 judgments for each stimulus distribution.

less than one-third of the time, and medium was used consistently somewhat more than either of the other two categories. This approximation to equal proportioning among the available judgment categories is especially meaningful when one remembers that the differences between stimulus items are supra-liminal.

The fact that there is a stable allocation of judgments between two categories, or among three if three are available, affords the key to the prediction of one determining parameter of the judgment distribution, namely, the subjective median. The subjects behave in the presence of these general instructions as if the stimulus items were to be assigned in accordance with certain fixed proportions. This self-imposed requirement is met in the two category case by assigning approximately half of the total number of stimuli presented to the longer category and half to the shorter despite differences from one stimulus population to another. In the three category case the shorter and longer categories are used with very nearly equal frequency and the middle category receives the residual. Either case of equipartitioning may be seen to provide the necessary and sufficient condition for a coincidence of the subjective and objective medians. This allocation tendency operates, of course, in conjunction with the ability of the subjects to discriminate accurately the lengths of the lines.

This correlation between objective and subjective medians is by no means perfect in the sense that the subjective median does not shift as far as the objective median but only in the appropriate direction. The next experiments were designed to deter-

mine whether the correlation can be reduced or enhanced by explicitly instructing the subjects to disregard or pay attention to the frequency aspect of the stimulus distribution. In addition, more explicit instructions might be expected to provide a more uniform basis for judgment and thus reduce the within-group variability characteristic of the previous experiments. The group curves for these experiments are not very typical of individual data as may be seen in Table VI where the range of individual values for Experiments I, II and IV is large for each item in the stimulus distributions.

TABLE VI

RANGE OF INDIVIDUAL SUBJECT VALUES FOR EACH ITEM IN THE STIMULUS DISTRIBUTIONS (IN TERMS OF PERCENTAGE OF LONGER JUDGMENTS)

EXPERIMENT I[a]

DISTRIBUTION	LINES 1	2	3	4	5
RECTANGULAR	0-50	0-70	3-80	30-97	77-100
SYMMETRICAL UNIMODAL	0-27	0-33	12-75	53-100	80-100
BIMODAL	0-45	7-67	30-90	73-100	95-100
SKEWED (-.92)	0-0	0-15	3-47	17-80	80-98
SKEWED (+.92)	0-28	15-73	53-93	85-100	100-100

EXPERIMENT II[b]

RECTANGULAR	0-50	3-70	27-80	60-97	83-100
SYMMETRICAL UNIMODAL	0-53	0-100	12-100	57-100	67-100
BIMODAL	0-92	0-100	0-100	57-100	80-100
SKEWED (-.92)	0-60	0-90	3-100	18-100	78-100

EXPERIMENT IV[c]

	1	3	5	7	9
RECTANGULAR	0-27	0-67	30-97	73-100	100-100
SYMMETRICAL UNIMODAL	0-13	0-17	12-68	83-100	80-100
BIMODAL	0- 5	0-30	0-80	50-97	93-100
SKEWED (-.92)	0- 0	0-15	3-50	50-100	98-100
SKEWED (+.92)	0-14	13-68	63-100	90-100	100-100

a. N = 10 for each item.
b. N = 7 for each item.
c. N = 10 for each item.

Experiment V

As a first approximation to providing a more uniform basis for judgment the subjects in Experiment V received the following instructions.

> You are going to see lines of different lengths flashed on the screen one at a time. You are to indicate whether a line is among the longer or shorter of the lines being presented. You are not to assume that there are equal numbers of short and long lines. In fact, your task is to make your judgments of longer and shorter represent only the longness or the shortness of the lines, even though you may feel that there are many more of one kind than of the other.
>
> To indicate .....(as in the general instructions).

The results obtained with this change in instructions may be seen in Figure 8. The previously noted differences in the forms of the distributions of judgments for symmetrical as opposed to asymmetrical stimulus distributions are not evident. The curves for the various distributions of stimulus items overlap indicating that the probability of assigning a given stimulus item to a given category appears to be relatively independent of the distribution in which the item occurs. In effect, the changed instructions appear to reduce greatly the influence of context. These results are in line with those obtained in a recent study by Doughty (2). He found that subjects in judging pitch were affected by asymmetry in the stimulus context even with foreknowledge of the unbalanced nature of the context but that the magnitude of the effect was significantly less with foreknowledge than without. The decrease in the correlation between objective

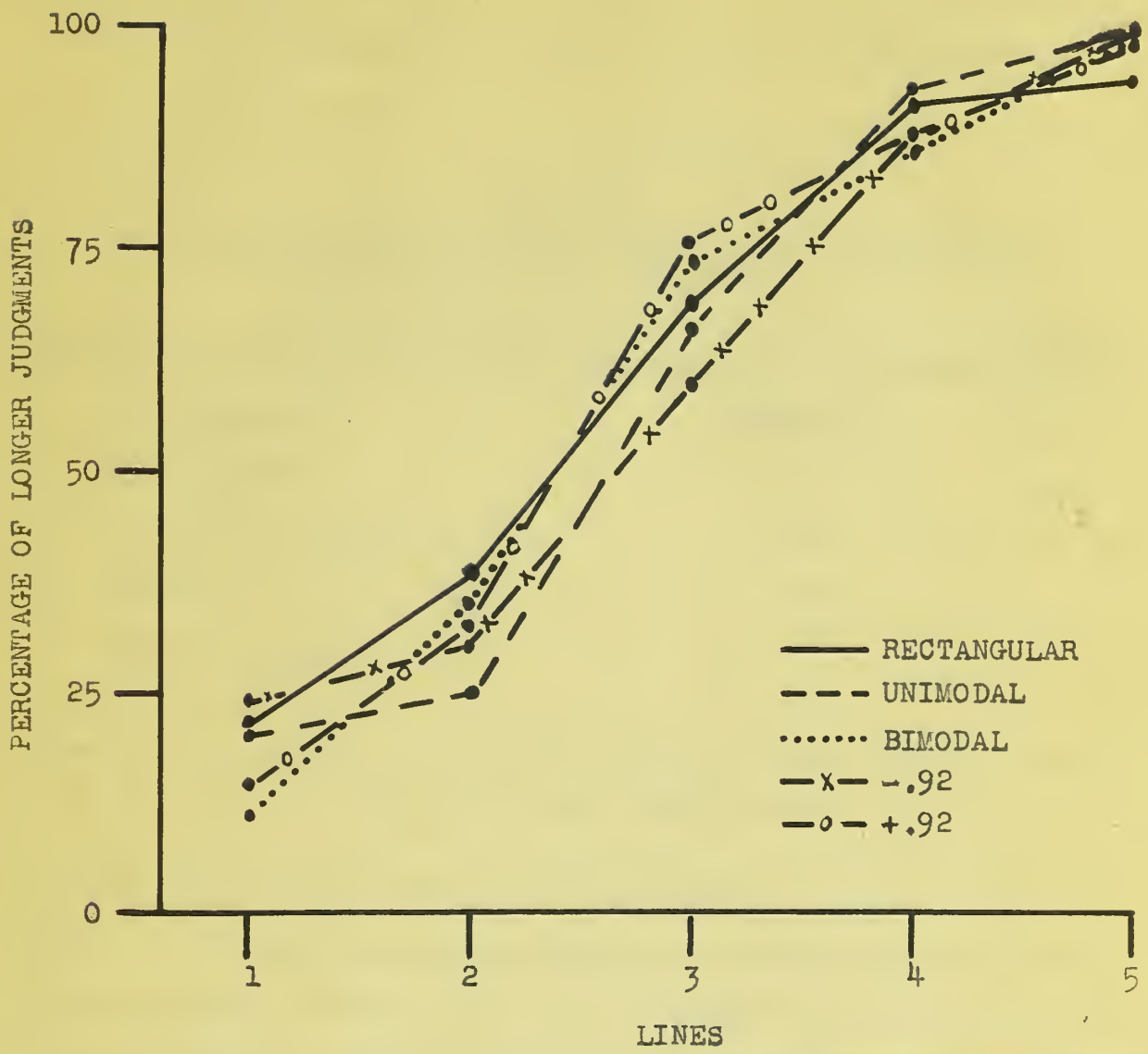


FIGURE 8 - MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT V)

and subjective medians is apparent also in Table VII where the total percentages of longer judgments for the skewed distributions reflect objective differences in these distributions.

TABLE VII

MEAN PERCENTAGE OF LONGER JUDGMENTS FOR ALL STIMULUS DISTRIBUTIONS IN EXPERIMENT V

DISTRIBUTION[a]	PERCENTAGE
RECTANGULAR	63
SYMMETRICAL UNIMODAL	62
BIMODAL	59
SKEWED (-.92)	74
SKEWED (+.92)	48

a. N = 1500 judgments for each distribution.

Although the group data are indicative of close similarity in all the judgment distributions the within-group variability is still large. These intersubject differences as presented in Table VIII point to the influence of non-stimulus determinants even with changed instructions which, not only, prepare the subjects for possible imbalance in the stimulus distribution, but also advise strongly against equal partitioning of judgments unless appropriate to the stimulus distribution.

This individual variability suggested an experiment to determine the extent to which subjects can use a certain instructionally specified feature of the stimulus distributions as the basis of their judgments.

TABLE VIII

RANGE OF INDIVIDUAL SUBJECT VALUES IN EXPERIMENT V FOR EACH STIMULUS ITEM (IN TERMS OF PERCENTAGE OF LONGER JUDGMENTS)[a]

DISTRIBUTION	LINES 1	2	3	4	5
RECTANGULAR	0-47	13-57	23-90	83-100	87-100
SYMMETRICAL UNIMODAL	0-100	0-100	35-100	83-100	100-100
BIMODAL	0-43	0-83	20-100	47-100	95-100
SKEWED (-.92)	0-30	0-100	23-100	60-100	100-100
SKEWED (+.92)	0-38	0-75	30-100	60-100	90-100

a. N = 10 for each item.

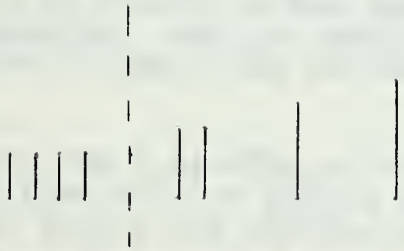
Experiment VI

Experiment VI differed in several ways from the previous experiments. The number of stimulus distributions was increased to seven and, of these, only one - the rectangular distribution - was symmetrical. The others varied over a fairly wide range of positive and negative skew as indicated in Table I. Three groups of ten subjects were given these seven distributions and each of the groups had a separate set of instructions. Group I was given the general instructions previously used in Experiments I - IV. Group II, on the other hand, was instructed to judge the items in terms of the median of the stimulus distribution. This group's instructions were:

You are going to see lines of different lengths flashed on the screen one at a time. After each line is presented you will be asked to indicate whether a line is among the longer or shorter of the lines presented. To do this accurately you must divide the lines into two equal groups of long and short judgments, so that the lines you call "longer" are the 50% of the lines which are longest and the lines you call "shorter" are the 50% of the lines which are shortest.

If you had a handful of different sized sticks you could sort them accurately into two equal piles.

If there were more sticks closer to the longest or shortest ones you could still divide all the sticks into two equal piles.



On the mimeographed sheets there are different collections of sticks all sorted for you. Draw a dotted line to separate the long sticks from the short ones so that there are equal numbers of short and long sticks.

At this point the subjects performed a simple task to indicate their grasp of the concept of the median. A sheet containing six collections of vertical lines of various lengths (similar to the illustrative ones in the text of the instructions) was given to each subject with the instructions to draw a line between the long and short lines. After the subjects demonstrated their ability to separate the lines correctly in terms

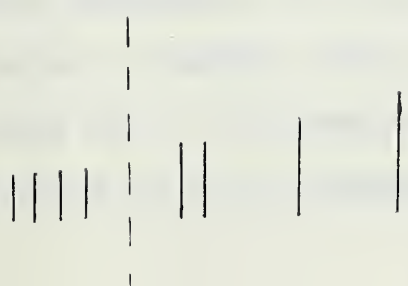
of the medians, the instructions were continued.

> Now we are ready to start looking at the lines on the screen. Although you will see only one line at a time you are to sort the lines into two equal groups of longer and shorter lines.
>
> To indicate your judgments ..... (as in the general instructions).

The instructions for Group III emphasized the midpoint of the range of stimulus items as the criterion of division between the longer and shorter lines. The exact wording of the instructions was as follows:

> You are going to see lines of different lengths flashed on the screen one at a time. After each line is presented you will be asked to indicate whether a line is among the longer or shorter of the lines presented. Call a line longer or shorter according to whether it is closer to the longest or shortest of the lines presented, that is, whether it lies between the line halfway between the extreme lines and either extreme.
>
> If you had a handful of different sized sticks you could line all the sticks up at once and decide which were longer and which were shorter.

> There might be more short sticks than long ones or vice-versa but you could still divide them at a point halfway between the longest and the shortest.



> On the mimeographed sheets there are different collections of sticks all sorted for you. Draw a dotted line to separate the long sticks from the short ones at the midpoint of the range.

As with the previous group of subjects this exercise provided the experimenter with concrete evidence that the subjects understood the criterion of division between the long and short lines.

> Now we are ready to start looking at the lines on the screen. Although you will see only one line at a time you are to sort the lines into two groups - longer and shorter - depending on which side of the midpoint of the range a given line falls.
>
> To indicate your judgments .....(as in the general instructions).

The data of this last experiment are examined most meaningfully in terms of comparison between the medians of the variously skewed stimulus distributions and the subjective medians of the judgment distributions. Figure 9 shows the data plotted in this manner for all three groups. The curve for Group II (median) approximates a straight line. The equation determined by the method of least squares which best fits the data of this group ($Y = .86X + .44$) is very close to the equation expressing a perfect linear relationship between the medians of the stimulus and judgment distributions. It thereby confirms the accuracy of the judgments made by the subjects instructed to use the median as a basis for their judgments. The curve for Group III (midpoint) also approximates a straight line ($Y = .10X + 2.42$) but with a negligible slope and a Y intercept which indicates the maintenance of a location near the midpoint of the range as the dividing

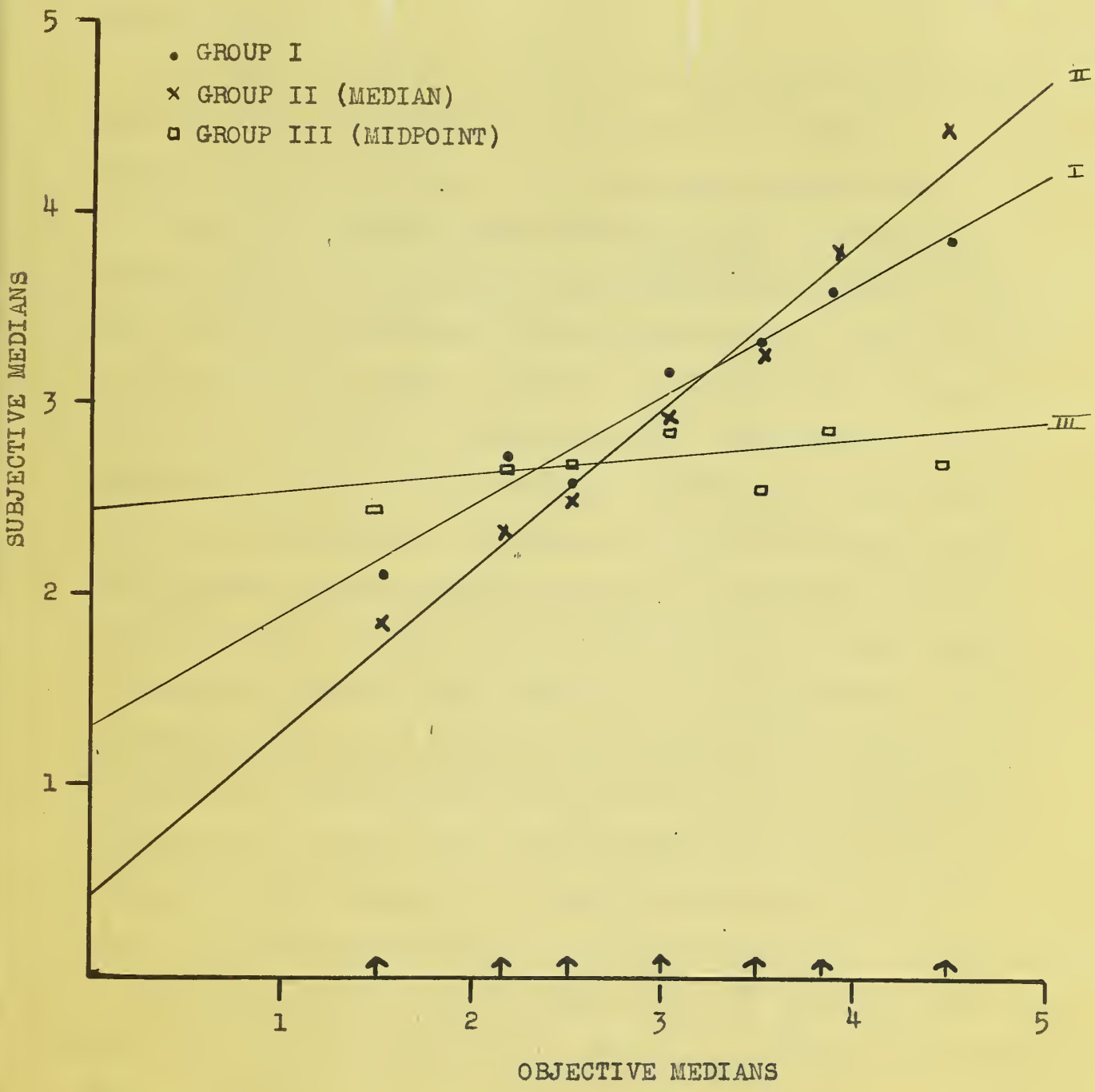


FIGURE 9 - SUBJECTIVE MEDIANS OF JUDGMENT DISTRIBUTIONS PLOTTED AGAINST OBJECTIVE MEDIANS OF STIMULUS DISTRIBUTIONS (SHOWN BY ARROWS) FOR GROUPS I, II AND III (EXPERIMENT IV)

point between longer and shorter judgments.

The curve for Group I (general instructions) does not present as uniform a function as either of the other two. The data points for the rectangular and least skewed distributions (-.32 and +.32) closely approximates the corresponding data points for Group II (median). The remaining four data points, however, do not correspond to those for Group II. The curve is a linear one (Y = .58X + 1.33) but, as can be seen in Figure 9, the slope is neither as steep as the one for Group II (median) nor as flat as the one for Group III (midpoint). From these data it is clear that the judgments of subjects given general instructions are not governed solely by an implicit notion of either the median of the stimulus distribution or the midpoint of the range of the items comprising the distribution. As further support for this interpretation variability measures are included with the subjective medians in Table IX, where it is readily seen that the small standard deviations for Group II (median) and III (midpoint) contrast sharply with those for Group I in every case except the initial rectangular distribution.

The data of this last experiment indicate a second effective way of reducing the influence of context on judgment distributions. Here the reduction was accomplished by instructions specifying the aspect of the stimulus distribution to be utilized as the basis of judgment in contrast to Experiment V where each line was judged on its own merit as a result of non-specific foreknowledge of possible imbalance in the stimulus distribution.

TABLE IX

MEAN VALUE AND STANDARD DEVIATION OF SUBJECTIVE MEDIANS OF GROUPS I, II AND III

DISTRIBUTION	GROUP I		GROUP II (MEDIAN)		GROUP III (MIDPOINT)	
	MEDIAN	SD	MEDIAN	SD	MEDIAN	SD
+1.22	2.14	.76	1.83	.26	2.42	.27
+ .92	2.75	.82	2.37	.24	2.70	.40
+ .32	2.61	.78	2.51	.22	2.65	.15
RECTANGULAR	3.19	.36	2.95	.18	2.94	.46
- .32	3.37	.83	3.29	.27	2.59	.27
- .92	3.61	.68	3.81	.38	2.92	.41
-1.22	3.88	.84	4.44	.07	2.74	.46
MEAN		.72		.23		.35

SUMMARY

The present study is composed of a series of six experiments in which subjects were required to judge the length of singly presented horizontal lines. The five different lines were presented in frequencies whose distribution forms were rectangular, symmetrical unimodal, bimodal and skewed. In addition to this basic variable of the form of the stimulus distribution the following factors were studied: number of judgment categories (two versus three), size of the step interval between adjacent stimulus items (five percent versus ten percent difference), experience with various stimulus distributions (independent subject groups for various stimulus distributions versus a single group for all distributions) and instructions of various degrees of specificity.

Under all conditions the subjects were able to make accurate judgments of single stimuli as found by Wever and Zener but under all conditions the form of the stimulus distribution profoundly

affected the form of the distribution of judgments. For symmetrical distributions the judgments yield a typical ogival psychophysical distribution. For asymmetrical distributions, however, the skew of the stimulus distribution is reflected in the skew of the judgment distribution. These relationships obtain independent of number of judgment categories, size of step interval and experience of subjects with a succession of different distributions.

Only when the instructions to the subjects were very general did the asymmetry of the stimulus population exert an effect on the judgment distribution. When the basis for judgment was left relatively unstructured there was a consistent correlation between the medians of the judgment and stimulus distributions. The behavior of the subjects was characterized by a tendency to assign equal numbers of stimuli to categories "longer" and "shorter" in both the two and three category judgment situation. This tendency appeared basic to the production of a correspondence between the central tendencies of the stimulus and response distributions.

When the instructions were more specific the correlation between medians of the judgment and stimulus distributions was heightened or lessened. It was shown that the correlation might be reduced in at least two ways, (1) by informing the subjects not to expect equal number of longer and shorter lines and (2) by specifying that judgments are to be based upon the midpoint of the stimulus range. In addition, it was shown that the correlation might be increased by requiring that the judgments be based upon the median of the stimulus distribution.

Under general instructions individual differences were large. Any change in the direction of greater specificity of instructions was accompanied by a decrease in within-group variability. Instructions to judge in terms of the midpoint or the median were relatively more effective in decreasing variability than information pertaining to possible inbalance in the stimulus distribution.

This study is in quantitative conformity with the generalization that distributions of judgments are influenced by the central tendency of the context of stimuli upon which they are based but it also demonstrates that this context effect may be maximized or minimized via experimental manipulation of the instructions.

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APPENDIX

FIGURE I

MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN THE SYMMETRICAL STIMULUS DISTRIBUTIONS (EXPERIMENT I)

DISTRIBUTION	LINES				
	1	2	3	4	5
Rectangular	11	22	50	76	94
Symmetrical unimodal	11	13	43	74	93
Bimodal	14	35	66	90	99

FIGURE 2

MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN THE ASYMMETRICAL STIMULUS DISTRIBUTIONS (EXPERIMENT I)

DISTRIBUTION	LINES				
	1	2	3	4	5
-.92	0	5	20	50	91
+.92	6	32	77	91	100

FIGURE 3

INDIVIDUAL SUBJECT VALUES IN PERCENTAGES OF LONGER JUDGMENTS FOR EACH LINE IN TWO SKEWED STIMULUS DISTRIBUTIONS (EXPERIMENT I)

DISTRIBUTION	LINES 1	2	3	4	5
	0	15	47	68	92
	0	5	37	80	96
	0	10	27	53	86
	0	5	10	40	80
-.92	0	10	20	38	98
	0	0	27	70	90
	0	0	7	43	94
	0	5	17	50	96
	0	0	23	38	94
	0	0	3	17	84
			17		
	2	23	93	95	100
	0	18	57	90	100
	4	15	70	85	100
+.92	0	15	53	85	100
	4	28	83	85	100
	0	40	80	100	100
	28	50	90	95	100
	8	45	90	100	100
	8	73	90	95	100
	8	15	67	81	100

FIGURE 4

MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT II)

	LINES				
DISTRIBUTION	1	2	3	4	5
RECTANGULAR	14	25	55	82	95
-.92	14	21	35	60	92
SYMMETRICAL UNIMODAL	11	23	48	80	90
BIMODAL	18	30	49	76	97

FIGURE 5

MEAN CATEGORY VALUE FOR EACH ITEM IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT III)

	LINES				
DISTRIBUTION	1	2	3	4	5
RECTANGULAR	1.29	1.50	1.84	2.33	2.84
SYMMETRICAL UNIMODAL	1.19	1.49	2.02	2.44	2.92
BIMODAL	1.25	1.60	2.05	2.33	2.83
-.92	1.11	1.23	1.64	2.12	2.73
+.92	1.42	1.90	2.41	2.72	2.97

FIGURE 6

MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT IV)

	LINES				
DISTRIBUTION	1	2	3	4	5
RECTANGULAR	6	24	65	93	100
UNIMODAL	3	8	46	95	97
BIMODAL	1	7	37	82	98
-.92	0	5	21	82	99
+.92	5	40	84	97	100

FIGURE 7

SUBJECTIVE MEDIANS OF JUDGMENT DISTRIBUTIONS PLOTTED AGAINST OBJECTIVE MEDIANS OF STIMULUS DISTRIBUTIONS IN EXPERIMENTS I, II, III AND IV

DISTRIBUTION	OBJECTIVE MEDIAN	SUBJECTIVE MEDIANS			
		I	II	III	IV
RECTANGULAR	3.00	3.26	2.75	3.20	2.66
UNIMODAL	3.00	3.24	2.93	2.96	3.01
BIMODAL	3.00	2.39	2.79	2.99	3.20
-.92	3.88	3.92	3.39	3.75	3.51
+.92	2.18	2.38		2.20	2.22

FIGURE 8

MEAN PERCENTAGE OF LONGER JUDGMENTS FOR EACH LINE IN VARIOUS STIMULUS DISTRIBUTIONS (EXPERIMENT V)

DISTRIBUTION	LINES				
	1	2	3	4	5
RECTANGULAR	22	38	69	92	94
UNIMODAL	21	25	66	93	100
BIMODAL	12	35	74	87	99
-.92	24	31	60	88	100
+.92	15	33	76	88	99

BIOGRAPHICAL NOTE

Date of birth:	October 14, 1927.
Place of birth:	Milton, Massachusetts.
Education:	Wheaton College, Norton, Massachusetts. September, 1944 - June, 1948. A. B. - June, 1948. Smith College, Northampton, Massachusetts. Teaching Fellowship - September, 1948 - June, 1950. M. A. - June, 1950. Duke University, Durham, North Carolina University Fellow - September, 1951 - June, 1952. Departmental Assistant - September, 1952-
Position:	Instructorship - Smith College, Northampton, Massachusetts, September, 1950 - June, 1951.
Membership:	Member: Society of the Sigma Xi.
Publications:	"The influence of size on preferences for rectangular proportion in children and adults." Journal of Experimental Psychology, 37, 1947. "The order of dominance among conceptual capacities: an experimental test of Heidbreder's hypothesis." The Journal of Psychology, 31, 1951.